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Consumption Rates of Potentially Hazardous Marine Fish Caught in the Metropolitan Los Angeles Area

University of Southern California, Los Angeles

Prepared for

Corvallis Environmental Research Lab., OR

Jun 82

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CONSUMPTION RATES OF POTENTIALLY HAZARDOUS MARINE FISH CAUGHT IN THE METROPOLITAN LOS ANGELES AREA

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ENVIRONMENTAL RESEARCH LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
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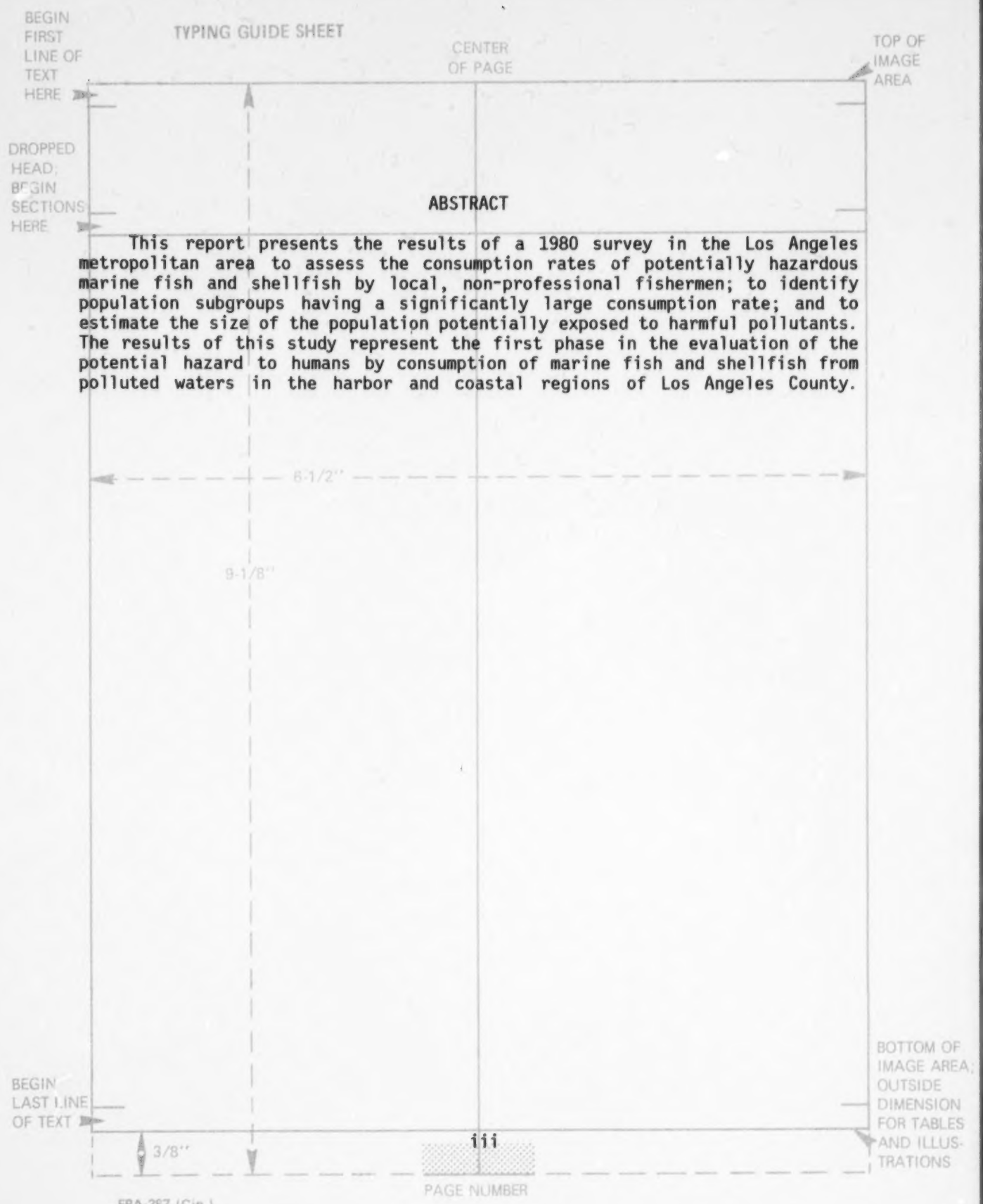

ABSTRACT

This report presents the results of a 1980 survey in the Los Angeles metropolitan area to assess the consumption rates of potentially hazardous marine fish and shellfish by local, non-professional fishermen; to identify population subgroups having a significantly large consumption rate; and to estimate the size of the population potentially exposed to harmful pollutants. The results of this study represent the first phase in the evaluation of the potential hazard to humans by consumption of marine fish and shellfish from polluted waters in the harbor and coastal regions of Los Angeles County.

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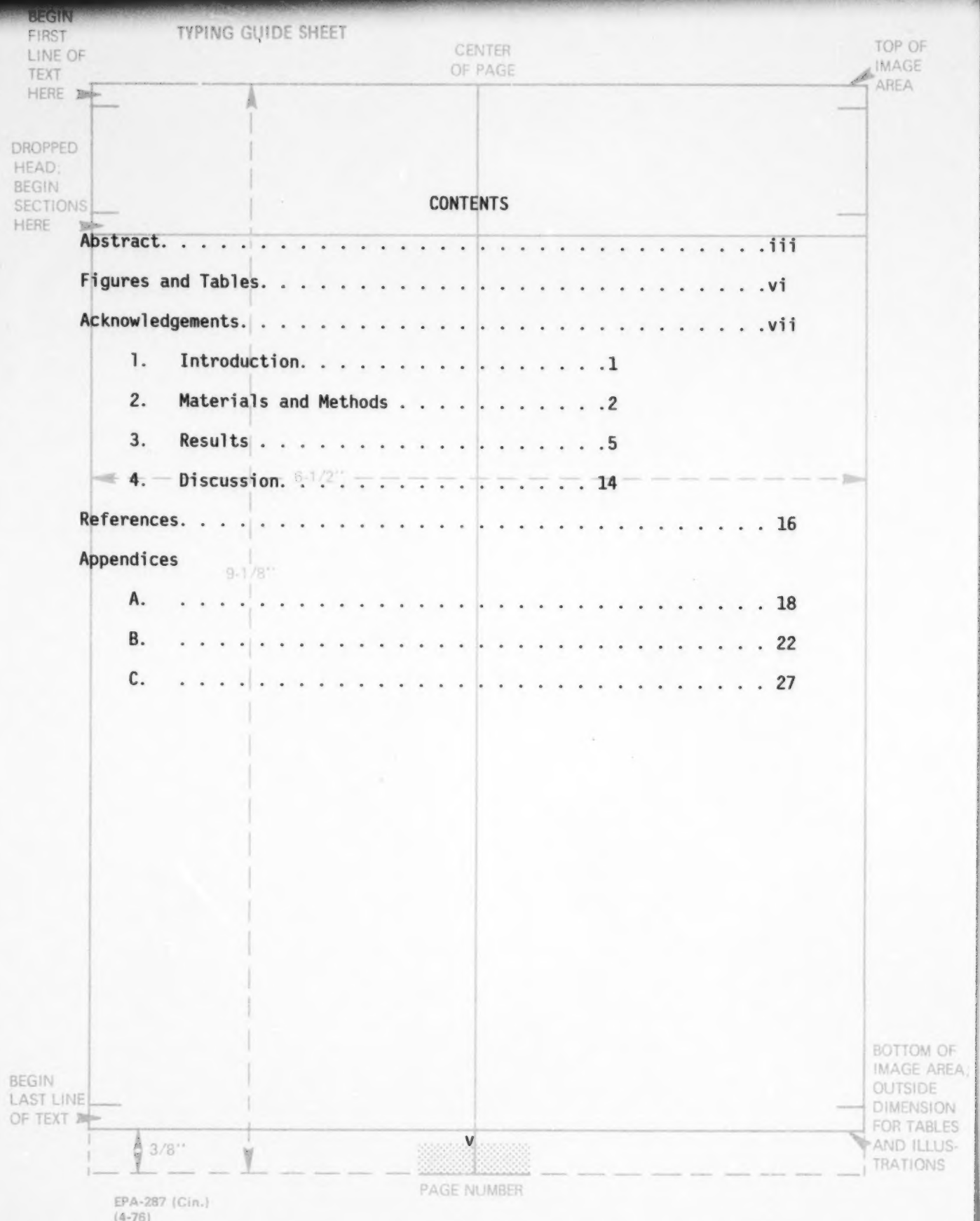

CONTENTS

Abstract. iii

Figures and Tables. vi

Acknowledgements. vii

1. Introduction. 1

2. Materials and Methods 2

3. Results 5

4. Discussion. 14

References. 16

Appendices

A. 18

B. 22

C. 27

EPA-287 (Cin.)
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FIGURES

Number		Page
1a	Location of survey sites (Team 1)	5
1b	Location of survey sites (Team 2)	6

TABLES

Number		Page
1	Demographic characteristics of interviewed sportfishermen	7
2	Estimated demographic characteristics of sportfishermen population.	7
3	Patterns of fishing activity and fish consumption for interviewed sportfishermen.	8
4	Description of primary fish kept by sportfishermen.	8
5	Description of consumption patterns for primary fish kept by sportfishermen.	9
6	Cumulative distribution of total fish and shellfish consumption	10
7	Analysis of median consumption rates.	11
8	Analysis of demographic characteristics of infrequent vs. frequent sportfishermen.	12
9	Size of population of sportfishermen in survey sites.	13
10	Estimated annual consumption of PCB	15

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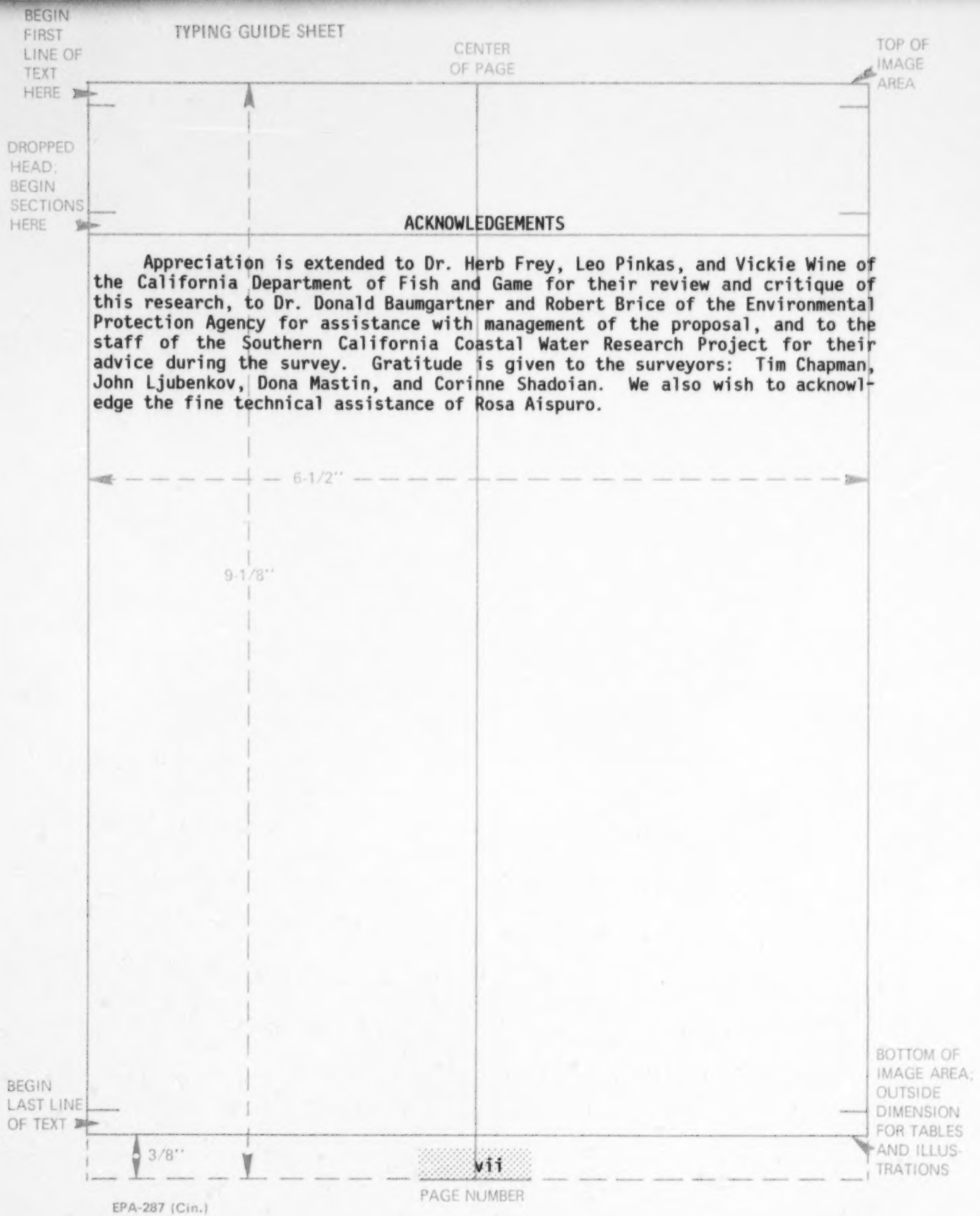
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SECTION 1

INTRODUCTION

In 1978, the California Department of Fish and Game carried out a major independent sportfishing survey in Southern California.[1] The results of that survey indicated that considerable fishing effort was expended (one million angler-trip hours per year), that 75% of the catch was composed of 20 species, and that one in three fish caught was a white croaker. White croaker has been shown to contain large amounts of DDT (average = 39 µg/g)[2] and polychlorinated biphenyl (PCB). Concentrations of PCBs have been shown to range from 0.6 µg/g within Los Angeles Harbor[3] to 2.8 µg/g near the White Point sewage outfall.[2] The survey also reported some catches of shellfish. Shellfish have been shown to be contaminated with heavy metals as well as the carcinogen benzo(a)pyrene[4] (BaP). No data were obtained, however, to demonstrate that direct consumption of fish or shellfish occurred in this population of sportfishermen.

This report presents the results of a 1980 survey in the Los Angeles metropolitan area to assess the consumption rates of potentially hazardous marine fish and shellfish by local, non-professional fishermen; to identify population subgroups having a significantly large consumption rate; and to estimate the size of the population potentially exposed to harmful pollutants. The results of this study represent the first phase in the evaluation of the potential hazard to humans by consumption of marine fish and shellfish from polluted waters in the harbor and coastal regions of Los Angeles County.

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SECTION 2

MATERIALS AND METHODS

During the design period of October 1979 to December 1979, a questionnaire on sportfishing and catch consumption was designed based on several pilot tests. The questionnaire (Appendix A) collected information on: (a) demographic characteristics of the fishermen and their family/living group; (b) patterns of fishing activity; (c) species, numbers, and weights of fish caught; and (d) characteristics of fish consumption in the family/living group. Distinction was made between those fishermen who caught fish for consumption and those who caught fish for other purposes. The final version of the questionnaire was designed for ease of coding and keypunching for computer analysis.

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LOCATION OF SURVEY SITES

During the design period, numerous fishing locations in the harbor and coastal areas of Los Angeles were evaluated as possible survey sites. Twelve representative locations were subsequently chosen for the survey. The California Department of Fish and Game confirmed that these sites (Figures 1a and 1b) were frequently used and contained abundant marine life.[5] In addition, they were affected by varying degrees of pollution.[6] Two of the sites (sites 7 and 8) were near sewage outfalls. The major Los Angeles County piers were included in the survey (sites 1, 5, and 8-11). Party boats (sites 6 and 12) were included because many sportfishermen do not fish from piers, shore, or breakwater areas. Fishermen utilizing private boats were excluded from this study because their fishing sites were too random, ranging from areas of pollution impact to pristine waters, and covered too broad an area to be surveyed adequately with the resources available.

SURVEYING PROCEDURES

Four surveyors visited each of the twelve sites, usually in teams of two. Attempts were made to survey each site approximately three times/month on different days of the week and different times of the day. The surveying period was January 1 through December 31, 1980.

Surveyors were selected on the basis of their Southern California fishing experience and their knowledge of marine life. Each team was composed of a male and female. Surveyors were presented with appropriate identification.

When the surveyors arrived at a sampling site, they recorded in a logbook the number of fishermen, their sex, race, and approximate age. All fishermen were counted whether or not they had caught fish. However, only those fishermen with fish were subsequently interviewed. No fisherman was interviewed

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more than once during the one year study period. When the number of fishermen with fish at the sampling site was greater than 20, a systematic sampling approach was used (Appendix B).

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Although it was not an essential part of the survey, attempts were made to obtain names and addresses of interviewed sportfishermen so that fishermen could be interviewed in more depth in subsequent research. As an incentive, fishing maps, regulations, and/or recipes were mailed to them.

Surveyors interviewed the sportfishermen, identified and counted the number of fish, and estimated the average weights using Ohaus Dial Spring scales (Appendix B). Surveyors also coded the questionnaire for keypunching. Photographs were taken frequently to assure the reliability of the surveyors' taxonomic identification of fish, to document site conditions, and to confirm sportfishermen counts.

DATA MANAGEMENT/STATISTICAL ANALYSIS

Questionnaires were submitted to the analyst/supervisor at biweekly meetings and reviewed for accuracy, consistency, and completeness. Data from questionnaires were keypunched and stored on computer disk, and analyses were carried out using the SPSS computer package.[7] Appendix C summarizes the codes and coding procedures.

The daily consumption of each species (grams/day/person) was calculated from the equation:

$$\text{Consumption} = k \times \frac{nw}{e} \times \frac{f}{365}$$

where k = edible portion (by weight) of fish ($\frac{1}{4} \leq k \leq \frac{1}{2}$, depending on species)

n = number of fish in catch

w = average weight (grams) of fish in catch

e = number of fish eaters in family/living group

f = frequency of fishing per year

Assumptions underlying this formula are that the number and average weight of the fish represent a "typical" catch for a given fisherman, the number of family fish eaters is constant over the study period, and the catch is shared equally among family members.

From the questionnaire data, demographic characteristics, and fishing activity of the sportfishermen, as well as average (median) consumption rates, were determined. Differences in median consumption rates were compared across sites and across demographic characteristics using the Kruskal-Wallis non-

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parametric analysis of variance procedure.[8] The size of the sportfishermen population was estimated from the logbook data. Details of the estimation procedure are presented in the next section (Table 9).

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SECTION 3

RESULTS

During the period of January 1 to December 31, 1980 a total of 1,059 interviews were conducted; 61% during the week, 39% on the weekend. Nearly two-thirds of the days were sunny, while the remainder were foggy, cloudy, or raining. During January, mid-February, and March, heavy rains reduced interviewing. Heavy erosion and landslide conditions closed Abalone Cove (site 7) from late March until November. Consequently, Point Vicente was substituted as a survey site (see Figure 1a and 1b). In early spring, quarantines were imposed for about ten days in Santa Monica Bay and Los Angeles/Long Beach harbors due to heavy sewage overflow. During that period, interviews could not be obtained. Also, Gerald Desmond bridge (site 3), which is not legally a public access bridge, was closed in March and from mid-September to December. Illegal disposal of chemicals caused closure of sites 9-11 from December 9 to 17.

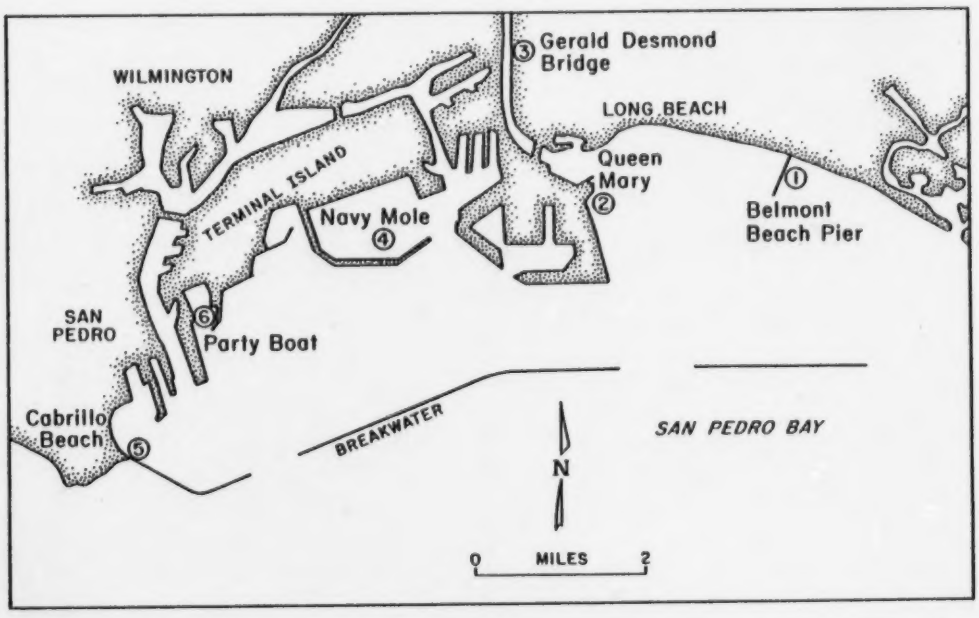

Figure 1a. Location of survey sites (Team 1).

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Figure 1b. Location of survey sites (Team 2).

Table 1 presents the demographic characteristics of the interviewed sportfishermen and their family/living groups. The majority of those interviewed were male, Caucasian, 18 to 40 years old, employed, and living with three or more persons.

Table 2 shows population estimates of the sex, age, and race distributions obtained from logbook data. When comparing Tables 1 and 2, it was apparent that youths ($\leq$ 17 years) who fished with their parents were underrepresented in the interviewed sample since, in most cases, the adult was interviewed as the representative family member. Also, Orientals (especially Samoans) and Mexican-Americans may be under-represented since a small portion of this population (5-10%) did not speak English and therefore could not be interviewed.

Table 3 presents patterns of fishing activity and fish consumption. Approximately half of the fishermen fished one or more times per week, and more than half had been fishing four or more hours at the time of the interview. The frequency of eating fish was generally the same as or larger than the frequency of fishing.

Table 4 presents a summary of the twelve primary fish species that were taken home (i.e, not thrown back or used as bait), the median number per catch, ad the average weight per species. White croaker were by far the most common fish caught. Shellfish, primarily crabs and mussels, constituted only 3% of the catch.

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TABLE 1. DEMOGRAPHIC CHARACTERISTICS OF INTERVIEWED SPORTFISHERMEN

(n = 1,059)

Sex		Age (years)		Race	
Male	88%	≤ 17	11%	Caucasian	42%
Female	12%	18 - 40	52%	Black	24%
		41 - 65	28%	Mexican-American	16%
		> 65	9%	Oriental/Samoan	13%
				Other	5%

Occupation		Number of Family Members*	
Student	14%	1	16%
Retired	14%	2	25%
Unemployed/Housewife	11%	3-4	30%
Professional/Manager/Sales	16%	5+	29%
Laborer	32%		
Employed - Other	13%		

* Includes fish consumers and non-consumers.

TABLE 2. ESTIMATED DEMOGRAPHIC CHARACTERISTICS OF SPORTFISHERMEN POPULATION

Sex		Age (years)		Race	
Male	84%	≤ 17	17%	Caucasian	38%
Female	16%	> 17	83%	Black	22%
				Mexican-American	21%
				Oriental/Samoan	19%

Table 5 presents a summary by species of the percent of fishermen who primarily consumed their fish or gave it away, the median amount of fish consumed, and the primary methods of preparation. The majority of fishermen interviewed supplemented their diet with the fish they caught, and the most common method of preparation was pan frying. Although few fishermen primarily ate raw fish, 8% said they ate it occasionally. Of the raw fish consumed, 16% were white croaker, 32% were bonito, and 12% were Pacific mackerel. Other uses of fish not shown in Table 5 included use as pet food and fertilizer.

Table 6 presents the cumulative distribution of total fish and shellfish consumption. The median amount consumed was 37 g/day/person, with the 90th percentile at 225 g/day/person (i.e., 10% of the fishermen consumed more than this amount). These figures are based on total grams of edible fish in each fisherman's catch regardless of species. Broken down by species, the consumption rate will differ, i.e., Table 10.

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TABLE 3. PATTERNS OF FISHING ACTIVITY AND FISH CONSUMPTION FOR INTERVIEWED SPORTFISHERMEN

(n = 1,059)

Frequency of Fishing in Area of Interview		Number of Adult Fish Eaters	
5-7 times/week	5%	None	2%
3-4 times/week	9%	One	24%
1-2 times/week	35%	Two	56%
1-3 times/month	23%	3-14	18%
Infrequently (< 1/mo)	28%		

Number of Child Fish Eaters		Frequency of Eating Fish		Freeze Fish for Later Consumption	
None	18%	5-7 times/week	5%	Yes	71%
One	24%	3-4 times/week	14%		
Two	25%	1-2 times/week	49%		
3-10	33%	1-3 times/month	23%		
		Infrequently (< 1/mo)	9%		

TABLE 4. DESCRIPTION OF PRIMARY FISH KEPT BY SPORTFISHERMEN

(n = 1,059)

Species	Percent of Fishermen Who Caught	Median Number (range)	Average (± sem) Weight (g)
White Croaker	34%	4 (1, 40)	153 ± 3
Pacific Mackerel	25%	4 (1, 56)	334 ± 9
Pacific Bonito	18%	2 (1, 55)	717 ± 26
Queenfish	17%	2 (1, 100+)	143 ± 5
Jacksmelt	13%	1 (1, 30)	223 ± 8
Walleye Perch	10%	2 (1, 21)	115 ± 5
Shiner Perch	7%	2 (1, 29)	54 ± 5
Opaleye	6%	2 (1, 13)	307 ± 38
Black Perch	5%	2 (1, 17)	196 ± 14
Kelp Bass	5%	1 (1, 7)	440 ± 61
California Halibut	4%	1 (1, 4)	1752 ± 144
Shellfish*	3%	3 (1, 84)	421 ± 124

* Crab (spider, red, yellow, rock), mussels, abalone.

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TABLE 5. DESCRIPTION OF CONSUMPTION PATTERNS FOR PRIMARY FISH KEPT BY SPORTFISHERMEN

(n = 1,059)

Species	Percent of Fishermen Who Consume	Percent of Fishermen Who Give Away	Median Consumption (g/day/person)	Primary Method of Cooking: Deep Fry	Pan Fry	Bake and Charcoal Broil	Raw	Other**
White Croaker	82%	15%	14.8	19%	64%	12%	0%	5%
Pacific Mackerel	74%	15%	35.8	10%	41%	28%	0%	21%
Pacific Bonito	77%	18%	63.6	5%	33%	43%	2%	17%
Queenfish	79%	13%	7.8	15%	70%	6%	1%	8%
Jacksmelt	78%	16%	9.4	17%	57%	19%	0%	7%
Walleye Perch	83%	7%	5.4	12%	69%	6%	0%	13%
Shiner Perch	67%	10%	2.0	11%	72%	8%	0%	11%
Opaleye	87%	7%	16.1	16%	56%	14%	0%	14%
Black Perch	89%	5%	8.1	18%	53%	14%	0%	15%
Kelp Bass	78%	2%	3.9	12%	55%	21%	0%	12%
California Halibut	86%	8%	143.1	13%	60%	24%	0%	3%
Shellfish*	97%	0%	10.0	0%	0%	0%	0%	100%

* Crab, mussels, abalone.
** Boil, soup, steam, stew.

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TABLE 6. CUMULATIVE DISTRIBUTION OF TOTAL FISH AND SHELLFISH CONSUMPTION

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Percentile	Consumption Rate* (g/day/person)
5%	2.3
10%	4.0
20%	8.3
30%	15.5
40%	23.9
50%	36.9
60%	53.2
70%	79.8
80%	120.8
90%	224.8
95%	338.8

* Based on total grams of fish regardless of species.

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Table 7 presents the median total fish consumption stratified by age, race, site, and fishing season. The Kruskal-Wallis analysis of variance test indicated significantly larger consumption rates among senior citizens (65 years or older) and among the Oriental/Samoan subgroup ($P < 0.001$). Also, significantly more fish were consumed from catches in site 8 ($P < 0.001$), a site likely to be influenced by waste discharge.

Table 8 compares the demographic characteristics of frequent versus infrequent fishermen. Chi-square tests of significance indicated that frequent fishermen tended to be older, Caucasian, and lived either alone or in a smaller family group.

Logbook data were used to estimate the size of the population of sport-fishermen at each of the 10 sites excluding party boats. Party boats were not included since no data were obtained on the number and size of all party boats in the Los Angeles coastal area. Estimates were based on fishermen counts obtained from the logbook data. Distinction was made between weekday and weekend counts.

For each weekday (or weekend day) the recorded count in the logbook represented the peak number of fishermen during the regular surveying hours. This count was an underestimate of the total number of fishermen at the survey site for the entire day. The peak numbers were averaged over all site visits to give 400 fishermen/day for all 10 sites on any weekday and 945 fishermen per day for all 10 sites on any weekend day. These averages ere then adjusted by weighting them by factors equal to the proportion of weekdays per year (= 261/365) and the number of weekend days per day (= 104/365). The weighted averages were 286 fishermen per day for all 10 sites on a weighted average weekend day. Thus, the average number of fishermen per day for any day was 286 + 269 = 555.

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TABLE 7. ANALYSIS OF MEDIAN CONSUMPTION RATES (g/day/person)

Age Group (years)	Median Consumption	P*
< 17	27.2	< 0.001
18 - 40	32.5	
41 - 65	39.0	
> 65	113.0	

Race	Median Consumption	P*
Caucasian	46.0	< 0.001
Black	24.2	
Mexican-American	33.0	
Oriental/Samoan	70.6	

Site	Median Consumption	Site	Median Consumption	P*
1	32.3	6,12	96.8	< 0.001
2	18.5	7	16.7	
3	26.3	8	62.5	
4	52.4	9	13.1	
5	36.3	10	47.7	
		11	49.5	

Season	Median Consumption	P*
Jan.-March, Nov., Dec.	36.3	NS
April - October	37.7	

* P value obtained from testing the hypothesis of equality of medians using the Kruskal-Wallis non-parametric analysis of variance test procedure.[8]

The average number of fishermen per day by frequency of fishing (Table 9a) was calculated by multiplying this total by the corresponding proportion of fishermen given in the fishing frequency statistics presented in Table 3. The total number of fishermen per year was obtained by multiplying the number of fishermen (by frequency category) by the number of days per year and dividing by a factor to account for the fact that the same fishermen were sometimes being counted more than once. Therefore, this factor represents the number of times that an individual fishermen is seen during the year. From these assumptions it was determined that there were at least 31,351 different sportfishermen per year at the 10 sites. Using data on the distribution of family fish eaters, the total number of people who eat fish caught by the 31,351 fishermen was estimated to be at least 100,950 (Table 9b).

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TABLE 8. ANALYSIS OF DEMOGRAPHIC CHARACTERISTICS OF INFREQUENT VS. FREQUENT SPORTFISHERMEN

Sex	Frequent (3-7 times/week)	Infrequent (all others)	P*
Male	86%	89%	NS
Female	14%	11%	
Age Group (years)			
< 17	8%	11%	< 0.0001
18 - 40	44%	54%	
41 - 65	27%	29%	
> 65	21%	6%	
Race			
Caucasian	59%	43%	< 0.005
Black	22%	26%	
Mexican-American	10%	18%	
Oriental/Samoan	9%	13%	
Number of Family Members†			
1	26%	14%	< 0.0001
2	33%	24%	
3-4	26%	31%	
5+	16%	31%	
Consumption Rates (g/day/person)	127.2	27.2	< 0.001

* P values obtained from chi-square tests of homogeneity for frequency data, and the Kruskal-Wallis non-parametric analysis of variance test for medians.[8]

† Includes fish consumers and non-consumers.

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TABLE 9. SIZE OF POPULATION OF SPORTFISHERMEN IN SURVEY SITES

a. Total Number of Fishermen Per Year by Frequency of Fishing

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Frequency of Fishing	%	Number of Fishermen per Day	Coefficient	Number of Fishermen per Year
Infrequent (< 1 mo)	28	155	365/2	28,288
1 - 3 times/month	23	128	365/24	1,947
1 - 2 times/week	35	194	365/72	983
3 - 4 times/week	9	50	365/182	100
5 - 7 times/week	5	28	365/312	33
Total	100	555	-------	31,351

b. Total Number of Family Members Who Are Fish Eaters

Number of Family Fish Eaters	%	Total Number
0	2	0
1	20	6,270
2	26	16,303
3	13	12,227
4	14	17,557
5	11	17,243
6	6	11,286
7-20	8	20,064
Total	100	100,950

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SECTION 4

DISCUSSION

This report represents the results of a fish consumption study carried out during 1980 to characterize sportfishermen and their catches in the coastal regions of Los Angeles County. A total of 400 visits were made to 12 sites (Figure 1); 1,059 interviews were completed from an estimated sportfishing population of at least 31,351 (Table 9). The median consumption rate was found to be 37 g/day--much higher than the average fish consumption for the U.S. population as a whole (estimated at about 18.7 g/day).[9] Although shoreline fishermen are shown to consume fish at rates considerably above the national average, it must be remembered that: (a) these data are biased toward frequent fishermen since they are more likely to be interviewed at any given time; (b) these data do not take into account consumption of store-bought fish or dietary sources which might be displaced by eating locally caught fish; and (c) the recorded catch may represent a fraction of the entire catch.

The results of this study also show that there exists a regular fishing population along the Southern California shoreline (14% fish 3 to 7 times/week), even at sites likely to be influenced by waste discharges (sites 7 and 8). Fish caught by frequent as well as infrequent fishermen are generally shared and consumed among at least 101,000 family members (Table 9).

The catches are dominated by a few species (Table 4) including two, white croaker and Pacific bonito, which accumulate trace organics including PCBs. PCBs have long been shown to produce toxic effects in prolonged industrial exposure[10-12] and affect children born to mothers exposed to oil contaminated by PCB.[13] They have also been found in the milk of nursing mothers in Michigan.[14]

Table 10 shows the estimated 50th percentile (median) and 90th percentile consumption levels of PCB for the edible portion of white croaker and Pacific bonito. Data on PCB concentrations for bonito were obtained in 1975-77 by trawl in the relative area of this survey.[2] Data on PCB concentrations for white croaker were recently reported by Young et al.[3] from fish taken in the outer Los Angeles harbor region of Cabrillo Beach. Based on these data, which may not be accurate for fish consumed in the present study, the annual median level of PCBs for white croaker consumption would be 3.2 mg (14.8 g/day x 0.6 µg/g x 365 days). Similarly, the annual median level of PCBs for bonito consumption would be 7.2 mg (63.6 g/day x 0.31 µg/g x 365 days). If one considers the population of heavy fish eaters at the 90th percentile, the annual consumption of PCBs would be 18.7 mg for white croaker and 37.8 mg for bonito. However, calculation of daily dose (Table 10) at the 50th percentile indicates a consumption below the permissible FDA guidelines of 1 µg/kg/day. At the 90th percentile the calculated dose approaches this permissible level

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TABLE 10. ESTIMATED ANNUAL CONSUMPTION OF PCB* (mg)

a. 50th Percentile

Species	Consumption Rate (g/day)	Concentration of PCB (µg/g)	Annual Consumption of PCB (mg)	Dose** µg/kg/day
White Croaker	14.8	0.60	3.2	0.13
Bonito	63.6	0.31	7.2	0.28

B. 90th Percentile

Species	Consumption Rate (g/day)	Concentration of PCB (µg/g)	Annual Consumption of PCB (mg)	Dose** µg/kg/day
White Croaker	85.2	0.60	18.7	0.73
Bonito	334.0	0.31	37.8	1.48

6-1/2"

* Data given are for edible portion.

9-1/8"

** Calculated as annual consumption per 70 kilogram average adult weight.

for white croaker and exceeds the level by 0.48 µg/kg/day for bonito. It is recognized that the 90th percentile population reportedly consumes high levels of white croaker (85.2 g/day) and bonito (334.0 g/day) which is considerably above the estimated national average. Although fishermen in the 90th percentile reportedly consume large amounts of fish, there is reasonable agreement between the consumption rate and the quantity of fish in their catch.

Despite what is known about the toxicity of PCBs, it is not yet possible to assign with any certainty a critical risk threshold. Therefore, the long-range public health significance of PCB contamination in humans remains unknown. We do feel, however, that sufficient data exist to warrant further studies. In particular, analyses of the twelve most prevalent fish being consumed should be undertaken to identify and quantify possible contaminants. The effect of cooking methods on levels of contaminants should also be examined. In addition, further work is needed to determine potential subpopulations at risk such as raw fish consumers, individuals over 65 years, Orientals and Samoans, and frequent fishermen at site 8 (Table 7). In-depth health assessments of these subpopulations must then be carried out.

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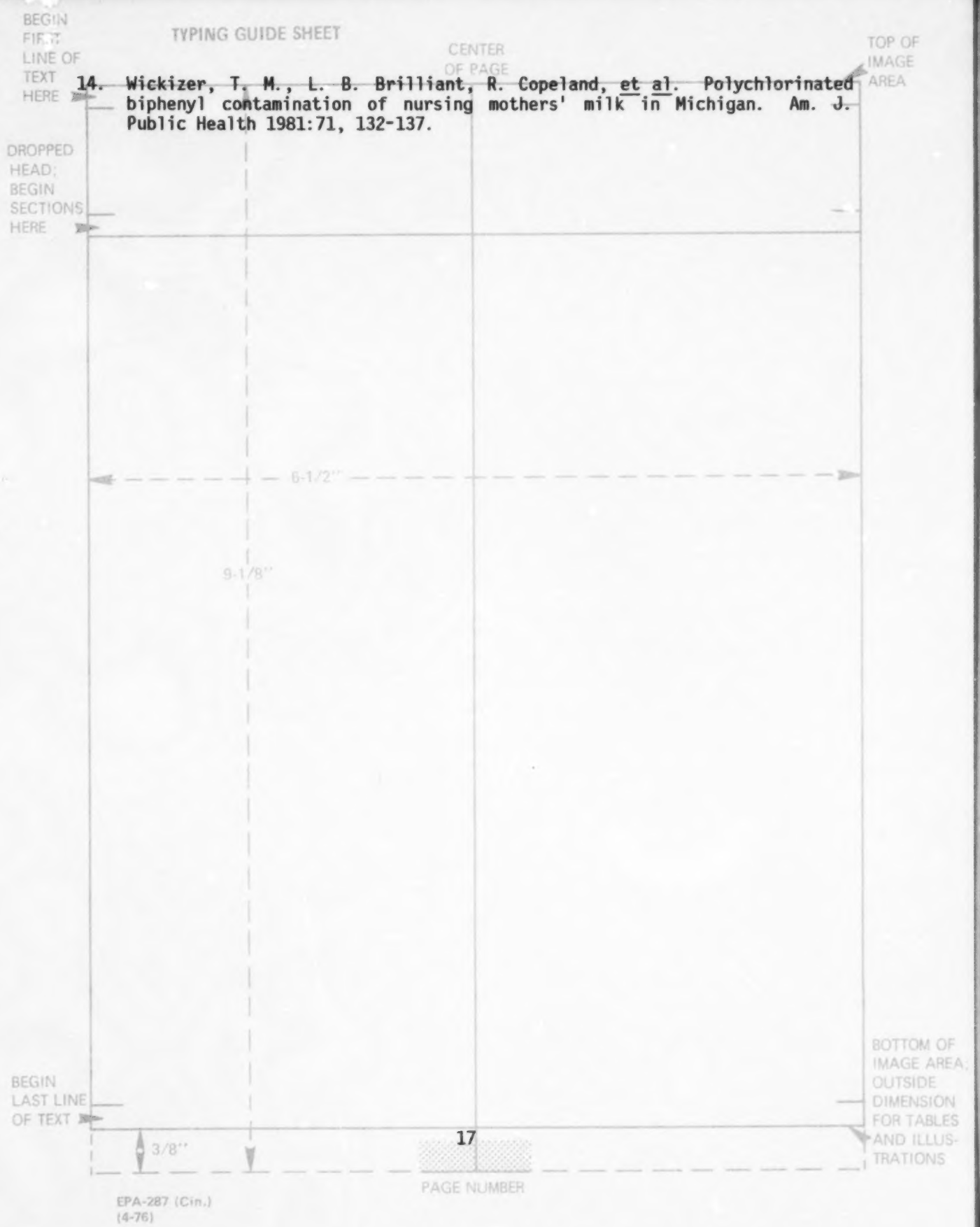

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APPENDIX A1

U.S.C. Fish Usage Survey

Sampler's name _____
Location: _____
Date _____ Day of Week: M Tu W Th Fri Sat Sun
Mo Day Year
Weather condition: (circle one)
1 = sunny
2 = foggy
3 = cloudy
4 = other (specify) _____
Temperature: (circle one)
1 = less than 60°F
2 = 60°F - 69°F
3 = 70°F - 79°F
4 = 80°F+
Tide: 1 = high 2 = low 3 = waxing 4 = waning
Time begin interviewing: __ __ : __ __ a.m./p.m.

Subject's name _____ Subject # _____
Subject address _____
Sex: M / F Year of birth _____ Phone # _____
Race: (circle one)
1 = Caucasian
2 = black
3 = Mexican
4 = Samoan
5 = Oriental
6 = Other (specify) _____
What is your native language?
1 = English
2 = Spanish
3 = Chinese
4 = Japanese
5 = Korean
7 = other (specify) _____

Occupation: (circle one)
1 = under 17 years old
2 = IF 17 years old or over, ask: Are you working or doing other things?
(a) working (specify) _____ type duration
(b) housekeeping
(c) student
(d) doing other things
3 = IF (d) checked, and person is 45 yrs. of older, ask: Are you retired: Yes / No

What city do you live in? _____ Zip Code _____
Do you generally fish in this area? Yes / No
How often (on the average) do you fish in this area? _____
1 = daily including weekends
2 = daily except weekends
3 = just weekends
4 = once a week
5 = twice a week
6 = 3 times a week
7 = 4 times a week
8 = once a month
9 = twice a month
10 = 3 times a month
11 = other (specify) _____
How long have you been fishing here today? _____
How many members in your family are living together now? _____
How many of them are adult fish eaters? _____
How many of them are children fish eaters? _____

Disposition: (circle one)
1 = interviewed - complete
2 = interviewed partial (refused to continue)
3 = refused - reason (specify) _____
4 = other (specify) _____

Time finished: __ __ : __ __ a.m. / p.m.

Date of form design 12/27/79
Date of form revision 1/5/80

Sampler I.D.	1
Zone #	2 3
Date	4 5 6 7 8 9
Day of week	10
Weather	11
Temperature	12
Tide	13
Time begin	14 15 16 17
Subject #	18 19 20
Sex	21
Birth year	22 23
Race	24
Native language	25
Occupation	26 27 28
Zip code	29 30 31 32 33
Fish in area	34
How often fishing	35 36
# of hours fishing	37 38
# of family	39 40
# of adult fish eaters	41 42
# of children fish eaters	43 44
Disposition	73
Time finished	74 75 76 77
Total # of type of fish	78 79
Card No.	1 80

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APPENDIX A2

U.S.C. Fish Usage Survey

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Sampler's name _____ Date of form design 12/27/79

Subject number _____ Date _____ (Month Day Year) Date of form revision 3/11/80

How often do you eat fish in general? _____ How often eat fish? 49 50

Do you stock your fish in freezer for later consumption? Yes / No — Stock fish 51

Do you fish in this area? — Fish in this area?

Gerald Desmond Bridge	Yes / No	
Queen Mary	Yes / No	52
Cabrillo Pier	Yes / No	
Palos Verdes Peninsula		53
(a) Point Fermin	Yes / No	
(b) White Point	Yes / No	54
(c) Abalone Cover	Yes / No	
Hermosa Pier	Yes / No	55
Redondo Pier	Yes / No	
Other _____		56
		57

(Code 8's if White Croaker is caught)

Do you catch White Croaker? Yes / No — White Croaker

Do you eat it? Yes / No — 58

If YES, how do you cook it? — Eat 59

1 = charcoal broil
2 = bake
3 = deep fry
4 = pan fry
5 = steam
6 = boil
7 = make soup
8 = raw
9 = stew
10 = other (specify) _____

Way cook 60 61

(Code 8's if Queen Fish is caught)

Do you catch Queen Fish? Yes / No — Queen Fish

Do you eat it? Yes / No — 62

If YES, how do you cook it? — Eat 63

1 = charcoal broil
2 = bake
3 = deep fry
4 = pan fry
5 = steam
6 = boil
7 = make soup
8 = raw
9 = stew
10 = other (specify) _____

Way cook 64 65

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APPENDIX A3

U.S.C. Fish Usage Survey

Sampler's name _____

Subject number _____ Date _____

(duplicate columns 1-20)

	Write in	Do not write					Write in	Do not write			
Type of fish/ shellfish	_____ _____	21	22	23	24	Type of fish/ shellfish	_____ _____	33	34	35	36
How many	_____	25	26			How many	_____	37	38		

Primary usage (circle one)	29	Primary usage (circle one)	29
1 = eat		1 = eat	
2 = feed to pet		2 = feed to pet	
3 = give away		3 = give away	
4 = use as fertilizer		4 = use as fertilizer	
5 = throw back		5 = throw back	
6 = use as bait		6 = use as bait	
7 = other (specify) _____		7 = other (specify) _____	

If eaten, method of cooking:	30 31	If eaten, method of cooking:	42 43
1 = charcoal broil		1 = charcoal broil	
2 = bake		2 = bake	
3 = deep fry		3 = deep fry	
4 = pan fry		4 = pan fry	
(a) butter		(a) butter	
(b) tomato sauce		(b) tomato sauce	
(c) garlic or other spices		(c) garlic or other spices	
5 = steam		5 = steam	
6 = boil		6 = boil	
7 = make soup		7 = make soup	
8 = raw		8 = raw	
9 = stew		9 = stew	
10 = other (specify) _____		10 = other (specify) _____	
Do you every eat it raw? Yes / No	32	Do you ever eat it raw? Yes / No	44

Observation: Way fish is kept (circle one) Way kept 79

1 = in a bucket of water
2 = in an ice chest
3 = let dry in air
4 = in sack
5 = specify

Card no. 2 80

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APPENDIX A4

U.S.C. Fish Usage Survey

Sampler's name _____

Subject number _____ Date _____

(duplicate columns 1-20)

	Write in	Do not write
Type of fish/ shellfish	_____ _____	45 46 47 48
How many	_____	49 50
List average weight	_____	51 52

Primary usage (circle one)
1 = eat — 53
2 = feed to pet
3 = give away
4 = use as fertilizer
5 = throw back
6 = use as bait
7 = other (specify) _____

If eaten, method of cooking: — 54 55
1 = charcoal broil
2 = bake
3 = deep fry
4 = pan fry
(a) butter
(b) tomato sauce
(c) garlic or other spices
5 = steam
6 = boil
7 = make soup
8 = raw
9 = stew
10 = other (specify) _____

Do you every eat it raw? Yes / No — 56

	Write in	Do not write
Type of fish/ shellfish	_____ _____	57 58 59 60
How many	_____	51 52
List average weight	_____	53 54

Primary usage (circle one)
1 = eat — 65
2 = feed to pet
3 = give away
4 = use as fertilizer
5 = throw back
6 = use as bait
7 = other (specify) _____

If eaten, method of cooking: — 66 67
1 = charcoal broil
2 = bake
3 = deep fry
4 = pan fry
(a) butter
(b) tomato sauce
(c) garlic or other spices
5 = steam
6 = boil
7 = make soup
8 = raw
9 = stew
10 = other (specify) _____

Do you ever eat it raw? Yes / No — 68

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Observation: Way fish is kept (circle one) — Way kept 79
1 = in a bucket of water
2 = in an ice chest
3 = let dry in air
4 = in sack
5 = specify

Card no. 2 / 80

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APPENDIX B1

INSTRUCTIONS TO SURVEYORS

A. Survey Method

Rules in conducting the interview.

1. Interview people only once. Methods of avoiding repetition:
   (a) by recognition
   (b) If no recognition, then ask:
      (i) Have you been interviewed for the "U.S.C. Fish Usage Survey" before?
      (ii) If YES, ask when.
         - If before January 1, 1980, then proceed with the interview.
         - If after January 1, 1981, then STOP.

If they agree to the interview, then give the individual the Surveyor's business card, thanking him/her for participating in this "U.S.C. Fish Usage Survey." The handling out of the I.D. card will identify this particular survey.

2. Do not interview anyone without any fish caught. Go back to that individual later.

Sample Size

Count the number of fishermen at time of entry. Fill in the log form. Break a day into two sections as morning and afternoon.

(a) If the number of fishermen is equal to or less than twenty, then proceed to interview them all.
(b) If number is 20 - 40, then interview every other one.
(c) If number is 40 - 60, then interview every third one.
(d) If number is 60 - 80, then interview every fourth one.

Random Sampling

By flipping coin to
(a) designate a type (either A or B)
(i) If "head" turns up, then Surveyor with odd number, i.e., #1 or #3 = A — Surveyor with even number, i.e., #2 or #4 = B
(ii) If "tail" turns up, then Surveyor with odd number = B — Surveyor with even number = A

(b) Choose a pattern
(i) If "head" turns up, then use this pattern:

Pick a land mark as the approximate middle.

A B

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(ii) If "tail" turns up, A starts at one end, B starts at middle, and both go in the same direction.

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B. Method for Filling Out Questionnaire

Location: (Refer to the hand out maps). The choice sites are:

1. Belmont Beach Pier
2. Queen Mary
3. Gerald Desmond Bidge
4. Navy Mole
5. Cabrillo Beach
6. Party Boat
7. Point Fermin, White Point, Abalone Cove
8. Redondo Beach, Hermosa Beach, Manhattan Beach
9. Marina Del Rey
10. Venice
11. Santa Monica
12. Party Boat

6-1/2"

Weather condition:
Determine by the condition at the time when the interview begins.

Temperature:
Determine by the readings indicated on the thermometer. Each surveyor should bring along a thermometer.

Tide:
If a distinction of whether high or low tide cannot be made, use the additional choices of waxing--water conditions approaching high tide, and waning--water conditions approaching low tide.

Time of interview:
Determine by the use of a watch, recording hours and minutes.

Subject number:
Assign each interviewee a number starting the first one with number 1 so on numerically. A number list is provided to each surveyor to aid him/her in remembering the last person he/she interviewed. Just make sure to cross off each number for each interview made.

Occupation:
Try to single out retiree and minor. If column 2 is filled, then follow up with questions on occupations. The key word is primary--any job that is held for a duration of at least a year. The phrase "doing other things" means the person is not formally employed at this moment.

Do you generally fish in the area?
"Area" refers to the location that is being interviewed at. Substitute the name of the location for area where the question is asked.

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Subject number:
Should match the same number as assigned on page 1.

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Type of fish/shellfish:
Refers to <u>one</u> <u>type</u> of fish/shellfish--to be recorded in each column. Thus, two types of fish/shellfish can be recorded on a page. Additional types of fish/shellfish have to be recorded on second page.

How many:
Actual count of type of fish/shellfish being caught.

List average weight:
Determine by the use of a scale. If amount of fish/shellfish is ≤3, weigh all, then take the average. If type of fish/shellfish caught is >3, weigh any random 3 and take the average.

Primary usage:
If an interviewee gave more than one answer, then try to prompt him/her to furnish more information so that a decision can be made as to answer the key question of "What happens to the <u>majority</u> of this type of fish/shellfish?"

6-1/2"

If eaten, method of cooking:
If two answers are given, then prompt him/her to tell which is his/her <u>favorite</u> way of cooking this particular type of fish/shellfish.

9-1/8"

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APPENDIX B4

U.S.C. Fish Usage Survey Log Sheet

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Date	Day of Week	Location	Time	No. of People Fishing			Comment
				Male	Female	Children	

6-1/2"

9-1/8"

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APPENDIX B5

U.S.C. Fish Usage Survey Time Card

Field Surveyor: _____ **Month:** _____

Date:	Day of Week:	Location:	Time:

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APPENDIX C1

Code Explanation for U.S.C. Fish Survey

SPSS Variable List	Column	Variable	Code	Code Instruction
ID	1	Sampler's name	1 = Corinne 2 = Donna 3 = John 4 = Tim	There are four Surveyors. Each is assigned a number.
Zone	2-3	Location, Zone #	1 = Belmont Beach Pier 2 = Queen Mary 3 = Gerald Desmond Bridge 4 = Navy Mole 5 = Cabrillo Beach 6 = Party Boat 7 = Point Fermin, White Point, Abalone Cove 8 = Redondo Beach 9 = Marina Del Rey 10 = Venice 11 = Santa Monica 12 = Party Boat	There are a total of 12 choice sites.
Date	4-9	Date	Month Day Year	Columns 4-5 are for coding of "month." Code 01 as in Jan. and 10 as in Oct., etc. Columns 6-7 are for coding of "day." Code 08 for the 8th, etc. Columns 8-9 are for coding of the year. Code 79 for 1979 and 80 for 1980.
DWK	10	Day of week	1 = Monday 2 = Tuesday 3 = Wednesday 4 = Thursday 5 = Friday 6 = Saturday 7 = Sunday	
WEATH	11	Weather	1 = sunny 2 = foggy 3 = cloudy 4 = other	

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EPA-287 (Cin.)
(4-76)

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APPENDIX C2

SPSS Variable List	Column	Variable	Code	Code Instruction
TEMP	12	Temperature	1 = less than 60°F 2 = 60°F - 60°F 3 = 70°F - 79°F 4 = 80°F +	
TIDE	13	Tide	1 = high 2 = low 3 = waxing 4 = waning	
TIMEB	14-17	Time begin interviewing	hours and minutes	Columns 14 and 15 are for coding of hours. Code 09 for 9 a.m. and 15 for 3 p.m., etc. Columns 16 and 17 are for coding of minutes. Code 40 for forty minutes, etc.
SUB	18-20	Subject #	Each subject is assigned a number and follows a sequential order.	Code 004 for #4 and 082 for #82 and 110 for #110, etc.
SEX	21	Sex	1 = male 2 = female	
BYR	22-23	Year of Birth	80 = unknown	Code 02 for 1902 and 34 for 1945, etc. and code 80 for unknown.
RACE	24	Race	1 = Caucasian 2 = Black 3 = Mexican 4 = Samoan 5 = Oriental 6 = other 9 = unknown	
NLG	25	Native language	1 = English 2 = Spanish 3 = Chinese 4 = Japanese 5 = Korean 6 = Filipino 7 = Other 9 = unknown	

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EPA-287 (Cin.)
(4-76)

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APPENDIX C3

SPSS Variable List	Column	Variable	Code	Code Instruction
OC	26	Occupation	1 = student 2 = employed 3 = retired 4 = unemployed 5 = housewife 9 = unknown	
EMPL	27-28	Employment	1 = professional, technical, and kindred workers 2 = managers and administrators 3 = sales workers 4 = clerical and kindred workers 5 = craftsmen, foremen, and kindred workers 6 = equipment operatives including transport 7 = laborers except farm workers 8 = farm workers 9 = service workers, including private household workers 10 = armed forces and public service workers (see Appendix I for more detailed classification)	
ZIP	29-33	Zip Code	According to the mailing code number as used by the postal service.	
FIAR	34	Fish in area	1 = yes 2 = no	
HOFL	35-36	How often fishing	1 = daily 2 = daily except weekends 3 = just weekends 4 = once a week 5 = twice a week 6 = 3 times a week 7 = 4 times a week 8 = once a month 9 = twice a month 10 = 3 times a month 11 = other	

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APPENDIX C4

SPSS Variable List	Column	Variable	Code	Code Instruction
HFRL	37-38	Number of hours fishing		Code 02 for two hours of fishing and 12 for twelve hours of fishing, etc.
FAM	39-40	Number in family		Code 04 for four members of family, and 10 for ten, etc.
AFIE	41-42	Number of adult fish eaters		
CFIE	43-44	Number of children fish eaters		If no children in the family, code it as 88 not applicable. If no fish eaters, code 00 in the space provided.
HOEF1	49-50	How often eat fish	1 = daily, including weekends 2 = daily, except weekends 3 = just weekends 4 = once a week 5 = twice a week 6 = 3 times a week 7 = 4 times a week 8 = once a month 9 = twice a month 10 = 3 times a month 11 = other	
STFL	51	Stock fish	1 = yes 2 = no	
GDB	52	Fish in Gerald Desmond Bridge	1 = yes 2 = no	
QM	53	Fish in Queen Mary	1 = yes 2 = no	
GAB	54	Fish in Cabrillo Beach	1 = yes 2 = no	
PVP	55	Fish in Palos Verdes	1 = yes 2 = no	
HER	56	Fish in Hermosa Pier	1 = yes 2 = no	
MAN	57	Fish in Mahattan Pier	1 = yes 2 = no	

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APPENDIX C5

SPSS Variable List	Column	Variable	Code	Code Instruction
WCROK	58	White Croaker caught	1 = yes 2 = no	
WEAT	59	Eat	1 = yes 2 = no	
WCOOK	60-61	Way cook	1 = charcoal broil 2 = bake 3 = deep fry 4 = pan fry 5 = steam 6 = boil 7 = make soup 8 = raw 9 = stew 10 = other	
QUF1	62	Queen fish caught	1 = yes 2 = no	
QEAT	63	Eat	1 = yes 2 = no	
Q	64-65	Way cook	1 = charcoal broil 2 = bake 3 = deep fry 4 = pan fry 5 = steam 6 = boil 7 = make soup 8 = raw 9 = stew 10 = other	
TIMEF	74-77	Time finished	Hours and minutes	Columns 74 and 75 are for coding of hours. Code 08 for 8 a.m and 14 for 2 p.m., etc. Columns 76 and 77 are for coding of minutes. Code 40 for forty minutes, etc.
NTYF1	78-79	Total number of type of fish		
CARDN1	80	Card numbers	1 = subject information 2 = fish card	

Note: code 8's for not applicable; code 9's for unknown.

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TOP OF IMAGE AREA

APPENDIX C6

SPSS Variable List	Column	Variable	Code	Code Instruction
TPFI1	1-20	Recap and duplicate information from Card 1		
TPFI1	21-24	Type of fish/ shellfish	Use the same codes as used by Department of Fish and Game (see Appendix II).	
AMT1	25-26	How many fish caught?		
WT1	27-28	List average weight	Estimate in ounces.	
USA1	29	Primary usage	1 = eat 2 = feet to pet 3 = give away 4 = use as fertilizer 5 = throw back 6 = use as bait 7 = other	
MCOOK1	30-31	If eaten, method of cooking	1 = charcoal broil 2 = bake 3 = deep fry 4 = pan fry 5 = steam 6 = boil 7 = make soup 8 = raw 9 = stew 10 = other	
ERAW1	32	Ever eat raw?	1 = yes 2 = no	
TPFI2	33-36	Second type of fish/shellfish	Use the same codes as used by Department of Fish and Game (see Appendix II)	
AMT2	37-38	How many		
WT2	39-40	List average weight	Estimate in ounces.	

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EPA-287 (Cin.)
(4-76)

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TOP OF IMAGE AREA

APPENDIX C7

SPSS Variable List	Column	Variable	Code	Code Instruction
USA2	41	Primary usage	1 = eat 2 = feed to pet 3 = give away 4 = use as fertilizer 5 = throw back 6 = use as bait 7 = other	
MCOOK2	42-43	If eaten, method of cooking	1 = charcoal broil 2 = bake 3 = deep fry 4 = pan fry 5 = steam 6 = boil 7 = make soup 8 = raw 9 = stew 10 = other	
ERAW2	44	Ever eat raw?	1 = yes 2 = no	
WFIK	79	Way fish is kept	1 = in a bucket of water 2 = in an ice chest 3 = let dry in air 4 = in sac 5 = other	
CARDN2	80	Card number	1 = subject information card 2 = fish card	

Note: Code 8's for not applicable
Code 9's for unknown

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EPA-287 (Cin.)
(4-76)

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APPENDIX C8

DEFINITION OF OCCUPATIONS

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1. Professional, technical, and kindred workers:
   - (a) Engineers, technical
   - (b) Physicians, dentists, and related practitioners
   - (c) Medical and other health workers except practitioners
   - (d) Teachers: elementary, secondary, and college

2. Managers and administrators, except farm:
   Salaried and self-employed: manufacturing, retail trade, and other industries

3. Sales workers:
   Manufacturing and wolesale trade
   Retail trade
   Other sales workers

4. Clerical and kindred workers:
   Bookkeepers
   Secretaries, stenographers, typists, and other clerical workers

5. Craftsmen, foremen, and kindred workers:
   Auto mechanics and body repair men
   Machinists
   Metal craftsmen
   Carpenters
   Construction craftsmen and other craftsmen

6. Equipment operatives including transport:
   Truck drivers and other transport
   Equipment operatives
   Durable goods, manufacturing
   Nondurable goods, manufacturing, and other non-manufacturing industries

7. Laborers, except farm:
   Construction laborers
   Freight, stock, and material handlers and other laborers

8. Farm workers:
   Farm laborers, unpaid family workers

9. Service workers, including private household:
   Cleaning service workers
   Food service workers
   Health service workers
   Personal service workers
   Protective service workers

10. Armed forces and public service workers:
    Navy, Marine, Air Force, Coast Guard, Army
    Policemen, Firemen
    Postal service man

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PAGE NUMBER

EPA-287 (Cin.)
(4-76)

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TOP OF IMAGE AREA

APPENDIX C9

CODES FOR TYPES OF FISH/SHELLFISH

Soupfin shark	0110	Blue rockfish	2330	Petrale sole	3103
Thresher shark	0111	Bocaccio	2334	Rock sole	3105
Gray smoothhound	0135	Canary rockfish	2335	Diamond turbot	3106
Blue shark	0137	Grass rockfish	2337	Spotted turbot	3107
Banjo fish (shark)	0138	Rosy rockfish	2339		
Brown smoothhound	0139	Flag rockfish	2341	Sargo	3200
Spiny dogfish	0163	Olive rockfish	2344		
Guitarfish	0212	Treefish	2345	Pampano	3300
Thornback	0213	Honeycomb rockfish	2346	Jack mackerel	3310
Bat ray	0240	Greenblotch rockfish	2363	Mexican scad	3312
		Unident. RF fillets	2398		
Silver salmon	1103	Cow cod	2399	Striped shore crab	5002
King salmon	1105	Redstriped rockfish	2390	Rock carb	5003
Pacific hake	1303			Red crab	5005
California lizardfish	1525	Sculpin	2453	Yellow crab (dungeness)	5006
		Cabezon	2410	Spider crab	5007
Kelp bass (calico bass)	2003			Blue crab (callinecter)	5008
Spotted sand bass	2005	White seabass	2504		
Barred sand bass	2006	White croaker	2509	Spiny lobster	5145
Striped bass	2007	Spotfin croaker	2511		
		Queenfish (herring)	2512	Abalone - general	5400
Barred perch	2104	Corbina	2513	Pine abalone	5412
Shiner surfperch	2105	Black croaker	2514	Black abalone	5413
Black surfperch	2107	Yellowfin croaker	2508	Green abalone	5415
Striped surfperch	2108			Red abalone	5416
Walleye surfperch	2110	Ocean whitefish	2610	White abalone	5417
Rainbow surfperch	2112	Halfmoon	2621		
White surfperch	2116	Opaleye	2625	Rock scallop	5524
Rubberlip surfperch	2117	Rock wrasse	2631		
Pile surfperch	2118	Senorita	2632	Albacore	5600
Redtail surfperch	2119	California sheephead	2633		
Silver surfperch	2120	Blacksmith	2640	Sea urchin (red)	5710
		Garibaldi	2641	Sea urchin (purple)	5711
Pacific mackerel	2209	Lingcod	2664	Pismo clams	5712
Pacific bonito	2210	Sablefish	2668	Littleheck clams	5713
		Topsmelt	2691	Mussel (California)	5714
Rock fish	2301	Jacksmelt	2692	Mussel (bay)	5715
Kelp rockfish	2302			Whelk (snail)	5716
Brown rockfish	2304	California barracuda	2720		
Gopher rockfish	2307	Giant kepfish	2757	Octopus	5800
Copper rockfish	2308	Fringehead and		Chiton	5850
Greenspotted rockfish	2309	other clinids	2758		
Starry rockfish	2311	Smooth ronquil	2759	Squid	5900
Greenstriped rockfish	2315			Anemone	5950
Chili pepper	2319	Salema	2800		
White bellied rockfish	2320			Triggerfish	6000
Widow rockfish	2316	Pacific sanddab	3001		
Yellowtail rockfish	2318	Bigmouth sole	3004		
Squarespot rockfish	2322	California halibut	3005		
Vermilion rockfish	2329				

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